

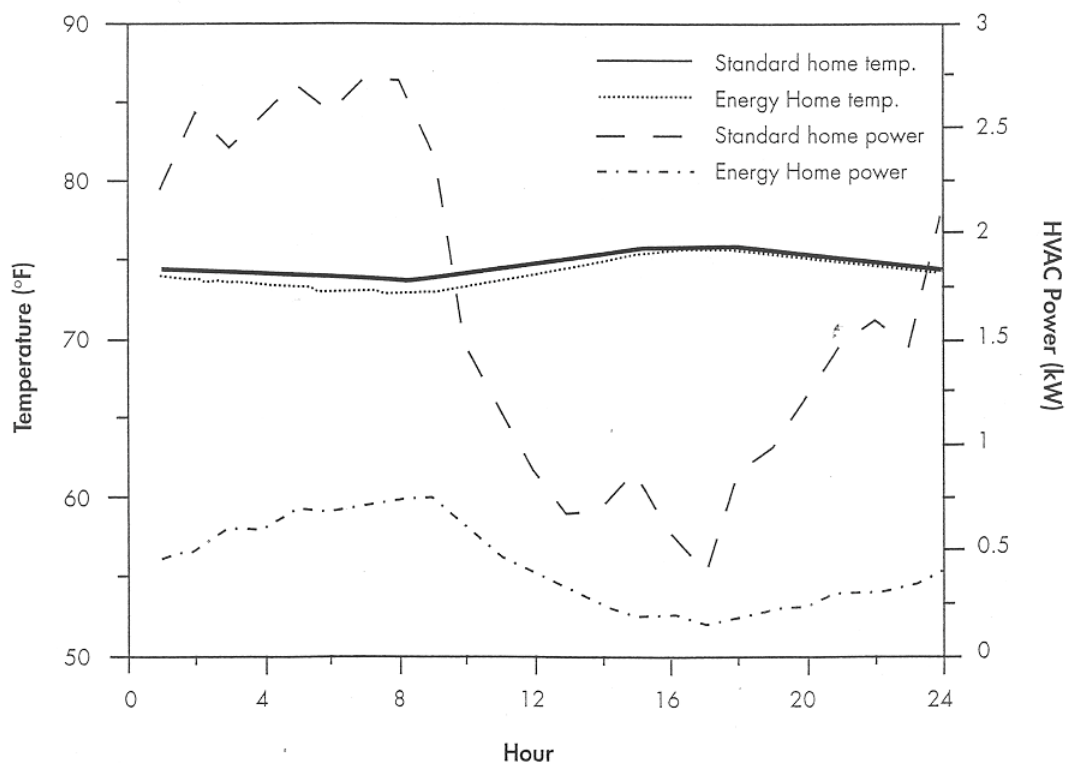
Energy-Efficient Manufactured Homes

Manufactured homes can be designed to be at least 60% more energy efficient than standard models currently rolling out of factories. That's a bold claim, but some research in North Carolina has the data to back it up. Since December 2000, North Carolina A&T State University (NCATU) has partnered with U.S. DOE's Building America Industrialized Housing Partnership (BAIHP) to monitor the energy efficiency of two homes manufactured by Palm Harbor Homes, Incorporated. The two homes were assembled side by side on the university campus. One was built to meet HUD standards while the other includes many

Table 1. Standard and Energy Home Construction

| Characteristic | Standard Home | Energy Home |
|--------------------|-----------------------------|------------------------------------|
| Floor insulation | R-11 | R-22 |
| Wall insulation | R-11 | R-13 |
| Ceiling insulation | R-20 | R-33 and roof deck radiant barrier |
| Windows | Single pane with storm | Low-e thermopane |
| Exterior doors | Storm door on front | Storm door on all |
| Marriage wall seal | Fiberglass pad | Soft-Seal gasket |
| Heating system | Electric resistance | Heat pump HSPF 7.5 |
| Cooling system | 10-SEER Central A/C, 3-ton | 12-SEER Central Heat Pump, 2-ton |
| Water heater | Electric | Solar |
| Duct joints | Industry standard | Sealed with mastic |
| Duct leakage | CFM ₂₅ out = 145 | CFM ₂₅ out = 83 |
| House leakage | ACH ₅₀ = 10 | ACH ₅₀ = 9 |

FSEC



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Figure 1. Although the standard home and the Energy Home remained at about the same interior temperature on a peak winter day, the Energy Home used much less power (10.1 kWh versus 39.4 kWh).

energy-saving upgrades (see Table 1). (For information about moisture problems in manufactured homes meeting HUD standards, see "Moisture Problems in Manufactured Housing," *HE* Mar/Apr '02, p. 24.)

Researchers working on the project have made a number of discoveries. Danny Parker of the Florida Solar Energy Center (FSEC), one of the project researchers, told *Home Energy* that setup matters. "After looking at the data that were coming off the site [of the Energy Home], we found that the cooling system wasn't working as efficiently as expected," he said. A trunk line that should have been attached to the rest of the ducts was open. Also, the blower speed on the heat pump unit of the more efficient home was set too high. When these uses were corrected, the cooling efficiency of the Energy Home, relative to the standard home, went from 10% more efficient to 40% more efficient.

The researchers probably wouldn't have discovered the problem if the Energy Home hadn't been extensively monitored and compared to the similar home next door (see Figure 1). (The data are available in real time over the Internet.) "A homeowner might notice the difference between expected performance and actual performance and write it off as just another instance of oversell," said Mark McGinley, another researcher on the project. "In fact, the home can perform as specified, only if installation hasn't been compromised." McGinley is developing a follow-up inspection checklist that would be performed by either the home's manufacturer or by a third party before the owner moves in.

The research team has also made some recommendations to Palm Harbor Homes about how to make the setup procedure more resistant to installation errors. "Better training of the field installers might help, but the real solution is to make it impossible to screw up in the first place," said Parker.

Data will be collected until July 2002. Before that time the researchers will make some changes to the homes. They will add an insulating blanket to the solar water heater storage tank in the Energy Home. Heat was lost at the tank in the winter and gained in the summer. The added summer heat had to be removed by the air conditioner. They will also install CFLs in both homes. They expect that the better-insulated Energy Home will benefit more by the reduced heat gain.



—Barry Harris

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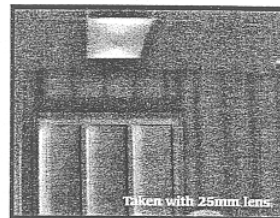
Real-time data from the manufactured home comparison study can be found at

www.fsec.ucf.edu/bldg/baihp/DATA/NCATU/index.htm.

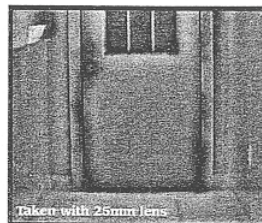
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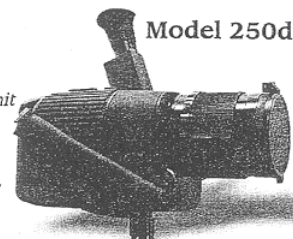
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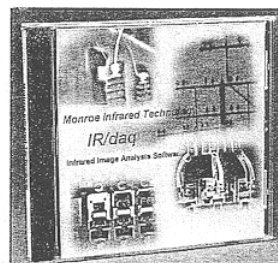
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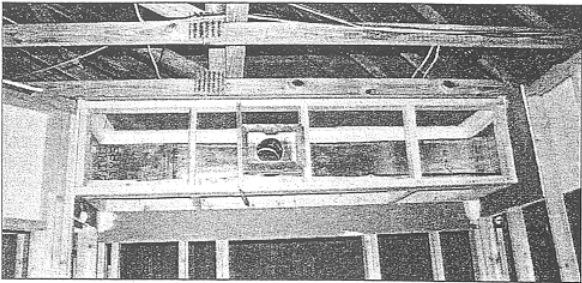


Leading the Refrigerant Charge

The Insider Duct Story

Solar Slam Dunk

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Cover Photo: Katy Boone is cutting a hole in a moldy exterior wall to document the wall design and construction materials. Photo by Clean Air Group, Inc.

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